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PROBLEMS FOR SOLUTION.

ALGEBRA.

250. Proposed by **PROFESSOR WILLIAM HOOVER, Ph. D., Athens, Ohio.**

Factor $a^2b^2(x^2+y^2)(a^2y^2+b^2x^2-a^2b^2)=(a^4y^2+b^4x^2)[\sqrt{}(a^2y^2+b^2x^2)+ab]^2$.

251. Proposed by **S. A. COREY, Hiteman, Iowa.**

Prove that $\frac{1}{n+1}+\frac{1}{2(n+2)}+\frac{1}{3(n+3)}+$ etc., $=$

$$\frac{1}{n^2}+\tfrac{1}{2}\left[\frac{1}{n-1}+\frac{1}{2(n-2)}+\frac{1}{3(n-3)}+\cdots\cdots+\frac{1}{l(n-l)}\right],$$

l being equal to $(n-1)$, n being any positive integer greater than one.

252. Proposed by **L. E. NEWCOMB, Los Gatos, Cal.**

Solve (1) $x-y=\frac{1}{3}\pi$; (2) $\sin x=\cos^3 y$.

AVERAGE AND PROBABILITY.

174. Proposed by **HENRY HEATON, Atlantic, Iowa.**

Chords are drawn through every point of the surface of a given circle in every possible direction. What is their average length?

175. Proposed by **R. D. CARMICHAEL, Hartselle, Ala.**

If a line l is divided into three parts by two points taken at random on it, what is the mean value of the triangle whose sides are equal to the three parts? (Only those cases are to be considered in which the the three parts will form a triangle.)

CALCULUS.

212.* Proposed by **O. E. GLENN, Ph. D., Springfield, Mo.**

Show that any root of the equation $y^5-5y=4x$ satisfies the differential equation $\frac{d^4y}{dx^4}=(\frac{4}{5})^4x^{-3}\frac{d^4(x^{-\frac{1}{5}}y)}{d(x^{-\frac{4}{5}})^4}$. Generalize the problem.

213. Proposed by **EDWIN L. RICH, Schenectady, N. Y.**

Let $f(x)$ be any function of x, and $f'(x)$ its derivative. If $u=[f'(x)]^{-\frac{1}{2}}$, $v=f(x)[f'(x)]^{-\frac{1}{2}}$, then $\frac{1}{u}\frac{d^2u}{dx^2}-\frac{1}{v}\frac{d^2v}{dx^2}=0$.

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*The problem is due to Heymann.

214. Proposed by R. D. CARMICHAEL, Hartselle, Ala.

Prove that $\pi^2=6.\frac{2^2}{2^2-1}.\frac{3^2}{3^2-1}.\frac{5^2}{5^2-1}$......... where the squared numbers in the numerator are the natural *primes* in order.

GEOMETRY.

277. Proposed by G. W. GREENWOOD, M. A., McKendree College, Lebanon, Ill.

It is tacitly assumed in elementary geometry that as the number of sides of a regular polygon inscribed in a circle is increased, *in any manner*, that its perimeter has a fixed limit. Beginning with a square and then continually doubling the number of sides we get for the perimeter $2^{n+2}\sqrt{[2-E^n(0)]}$, where $E(x)\equiv\sqrt{(2+x)}$. Beginning with a hexagon we get $2^{m+1}3\sqrt{[2-E^m(1)]}$. The definition of the length of a circle assumes that these expressions have the same limit as $n\doteq\infty$ and $m\doteq\infty$. Prove it.

278. Proposed by L. E. NEWCOMB, Los Gatos, Cal.

AF, MN are parallel lines indefinitely extended toward FN; at right angles to AF, MN is AM of length 22; upon the base AB, which is in line with AM, is the triangle ABC whose sides are $AB=21$, $BC=10$, $AC=17$; find the sides of the maximum similar triangle with base extending from B to some point in AF, the vertex in line with MN.

279. Proposed by C. C. WENTWORTH, C. E., Roanoke, Va.

To construct geometrically the maximum equilateral triangle circumscribed about a given triangle.

GROUP THEORY.

12. Proposed by GEORGE H. HALLETT, Ph. D., Assistant Professor of Mathematics, The University of Pennsylvania.

*Given $U_1=\alpha'$, $V_1=\beta'$, and the recursion formulae $U_y=\alpha' V_{y-1}+\alpha'' U_{y-1}$, $V_y=\beta' V_{y-1}+\beta'' U_{y-1}$. Find expressions for U_y, V_y in terms of the coefficients α', α'', β', β''.

13. Proposed by O. E. GLENN, Ph. D., Springfield, Mo.

The order of the linear homogeneous group in n letters is $(p^n-1)(p^n-p)$ ....(p^n-p^{n-1}). Two proofs are given in Burnside's *Finite Groups*. Give other proofs.

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*The problem is of frequent occurrence in abstract group construction.